

ABSTRACT

Production of and uses for flax seed having a linolenic acid content of greater than 65% based on total fatty acid content are described.

Table 1. Fatty Acid Composition of Major Seed Oils

	Fatty Acid Content %			
	Saturates	Oleic	Linoleic	Linolenic
Linseed Flax	9	20	13	58
Canola	6	58	26	10
Safflower	9	20	70	<1
Sunflower	11	20	69	-
Corn	13	25	61	1
Olive	14	77	8	1
Soybean	15	24	54	7
Peanut	18	48	34	-
Cottonseed	27	19	54	-

Source: Agricultural Handbook No. 8-4. Human Nutr. Inform. Serv., U.S. Dept. Agric., Washington, DC. 1979.

Table 2. Fatty Acid Composition of Linseed Flax and High Linolenic Flax (M 5791)

Fatty acid, % in oil		Linseed Flax	High Linolenic Flax
Palmitic	C16:0	5.4	4.5
Stearic	C18:0	3.1	2.2
Oleic	C18:1	17.1	9.7
Linoleic	C18:2	14.7	10.8
Linolenic	C18:3	59.6	72.8
Iodine value		196	217

JOURNAL OF POLYMER SCIENCE: PART A: POLYMERS FOR ADVANCED TECHNOLOGIES, VOL. 32, NO. 1, JANUARY 1994

Table 3. Linolenic Acid Content of Canadian Flaxseed by Province - 1992-1999*

	Manitoba	Saskatchewan	Alberta	Mean
1992	59.1	58.7	55.7	58.8
1993	57.9	61.0	60.7	59.7
1994	58.6	60.5	56.9	59.6
1995	55.8	59.4	60.8	58.1
1996	57.8	59.3	59.8	58.7
1997	58.8	57.4	58.9	58.0
1998	57.2	56.6	56.9	56.8
1999	60.4	59.4	59.0	59.6
Mean	58.2	59.0	58.6	58.7

Source: Quality of Western Canadian flaxseed, Grain Research Laboratory, Canadian Grain Commission, Winnipeg, MB. Linolenic acid determined by gas chromatography of methyl esters of fatty acids according to International Organization for Standardization; Animal and vegetable fats and oils 1505508:1990E.

Table 4. Linolenic Acid Content of Four Widely Grown Canadian Flax Cultivars in Flax Cooperative Tests* conducted at Eight Locations in Manitoba and Saskatchewan, 1995-1999.

	Manitoba					Saskatchewan			Mean
	Morden	Portage la Prairie	Roseba nk	Brandon	Indian Head		Melfort	Saskatoon	
					n	n	n	n	
1995									
AC McDuff	52.5	53.8	53.5	49.0	57.2	56.2	54.9	56.2	54.2
CDC Normandy	54.0	55.7	55.8	52.8	60.2	56.8	56.5	58.7	56.3
Flanders	55.0	56.5	56.3	52.0	60.2	58.9	57.5	58.9	56.9
NorLin	53.8	55.4	54.5	53.1	60.0	56.7	56.5	58.9	56.1
Mean	53.8	55.4	55.0	51.7	59.4	57.1	56.3	58.2	55.9
1996									
AC McDuff	53.6	55.2	55.5	52.6	55.4	53.8	54.4	56.0	54.6
CDC Normandy	55.8	54.6	57.6	54.9	58.2	56.7	56.4	58.1	56.5
Flanders	57.3	58.3	58.0	54.3	57.8	56.2	56.8	558.7	57.2
NorLin	55.2	54.2	56.8	54.7	57.8	55.4	56.0	57.7	56.0
Mean	55.5	55.6	57.0	54.1	57.3	55.5	55.9	57.6	56.0
1997									
AC McDuff	53.3	55.4	56.0	52.2	49.7	53.1	52.1	50.6	52.8
CDC Normandy	53.0	55.0	58.0	52.1	52.9	51.6	55.1	54.3	54.0
Flanders	55.9	58.9	58.1	53.8	53.9	54.8	55.1	53.7	55.5
NorLin	52.9	56.8	57.7	53.1	51.9	52.5	55.4	53.9	54.3
Mean	53.8	56.5	57.4	52.8	52.1	53.0	54.4	53.1	54.1
1998									
AC McDuff	51.5	51.9	51.4	46.9	50.8	47.9	51.4	52.3	48.2
CDC Normandy	53.8	53.2	53.2	48.9	53.7	53.5	52.7	53.0	47.8
Flanders	52.6	54.3	54.6	49.7	53.5	50.0	53.4	51.3	48.0
NorLin	52.7	53.5	54.0	49.8	53.4	52.8	50.7	51.5	47.4
Mean	52.6	53.2	53.3	48.8					

Table 4 (Continued)

	Manitoba			Saskatchewan			Mean		
	Morden	Portage la Prairie	Roseba nk	Brandon	Indian Head	Melfort	Saskatoo	Scott	
1999									
AC McDuff	57.1	58.8	59.2	58.4	59.8	53.4	51.6	52.0	56.3
CDC Normandy	59.9	59.0	60.0	58.2	60.1	53.5	56.1	55.5	57.8
Flanders	60.2	61.1	62.4	49.0	61.4	54.6	54.7	55.6	58.7
NorLin	59.4	59.0	59.8	58.8	59.4	53.3	55.4	54.9	57.5
Mean	59.1	59.6	60.3	58.6	60.2	53.7	54.4	54.5	57.6
Overall Mean	55.0	56.0	56.6	53.2	56.4	54.0	54.5	54.2	

* Cooperative tests conducted by Prairie Registration Recommending Committee on Grain. Linolenic acid content determined by gas-liquid chromatography of the fatty acid esters using the method described by Daun et al., J. Amer. Oil Chemists' Society, 60, 1983.

Table 5. Linolenic Acid Content* of High Linolenic Flax (M 5791) in Replicated Trials in Manitoba, 1998 & 1999, in Comparison with Three Commercial Cultivars

	Morden	Burdick	Portage la Prairie
<u>1998</u>			
High Linolenic Flax	70.1		
AC Emerson	57.0		
Flanders	53.1		
NorLin	55.2		
<u>1999</u>			
<u>Test 1</u>			
High Linolenic Flax	70.9	71.9	72.7
AC Emerson	61.7	60.6	65.1
Flanders	60.4	60.6	62.5
NorLin	59.7	57.8	59.3
<u>Test 2</u>			
High Linolenic Flax	71.9	70.3	
AC Emerson	58.6	59.2	
Flanders	58.2	60.3	
NorLin	56.9	59.3	
<u>Test 3</u>			
High Linolenic Flax	72.0	71.3	
AC Emerson	60.5	61.6	
Flanders	60.0	60.9	
NorLin	58.6	58.2	

* Linolenic acid content determined by gas-liquid chromatography of the fatty acid esters using the method described by Daun et al., J. Amer. Oil Chemists' Society, 60, 1983.

Table 6. Linolenic Acid Content of High Linolenic Flax (M 5791) in Field Trials, 1998 & 1999

Location	Year	% Linolenic Content
Fisher Branch, MB	1998	72.7
	Field 1	
	1999	72.7
	Field 2	
		72.2
Erickson, MB	1998	72.9
	Field 1	
	1999	72.9
	Field 2	
		72.9
Gadsby, AB	1998	72.6
	Field 1	
	1999	72.6
	Field 2	
		73.1

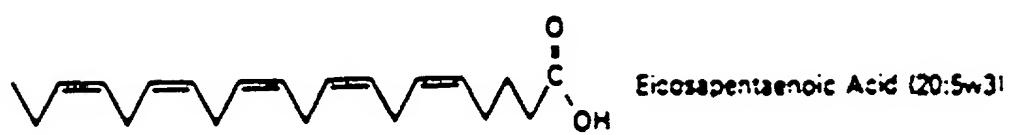
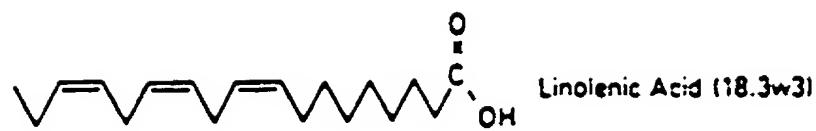


Figure 1. Structural formulas for fatty acids. The first number (before the colon) gives the number of carbon atoms in the molecule and the second gives the number of double bonds. w3, w6, and w9 indicate the position of the first double bond in a given fatty acid molecule.

Elongation and desaturation of n-6 and n-3 polyunsaturated fatty acids

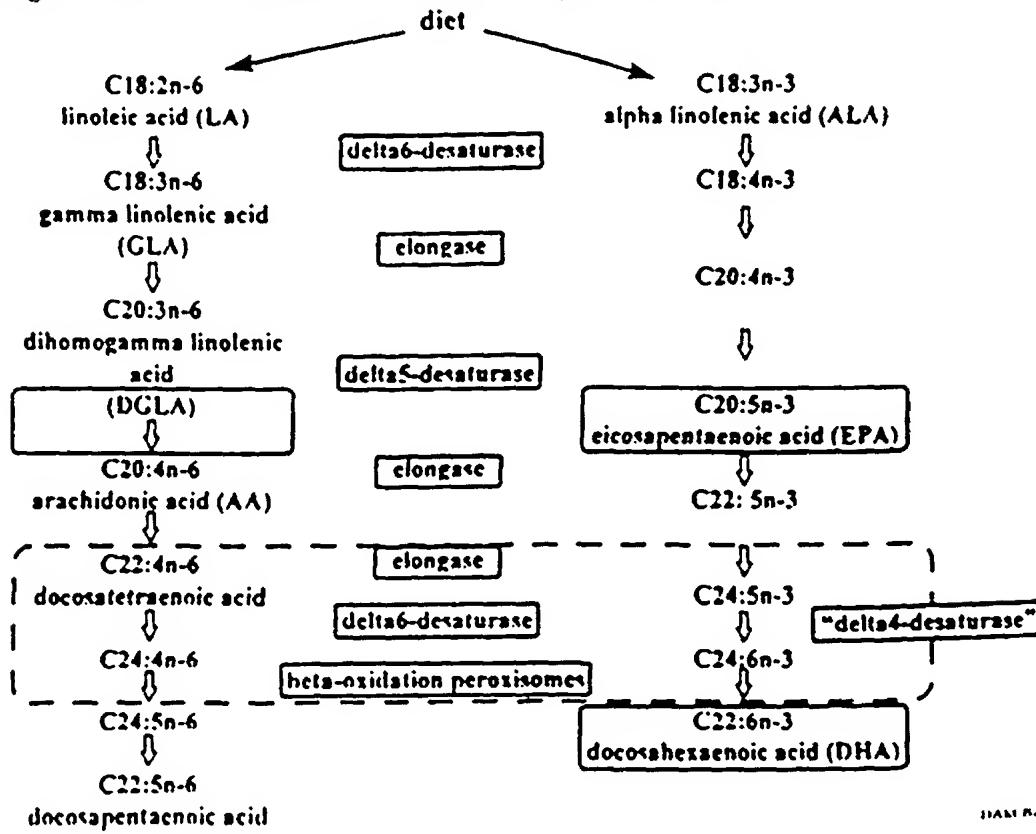


Figure 2 Essential fatty acid metabolism: desaturation and elongation of ω6 and ω3

Uses of Flax

Linseed Oil (High Linolenic Acid)	Adhesives, i.e. manufacture of hardboard and fibreboard Protective Coatings: paints, house paint primers, varnishes, lacquers, stains, alkyd resins, enamels, epoxidized oils
Raw & Refined Boiled & Blown Grinding Oils Heat Boiled (polymerized oils)	Floor Covering: linoleum Oilcloth, tarpaulin and other coated fabrics Patent leather Industrial Chemicals: fatty acids, soap, glycerin Printing inks, grinding oils, newsprint, core oils, caulking compounds, waterproofing compounds, mastic cements, foundry binders, brake lining, hardboard, shoe polish, herbicide and pesticide carrier Antispalling and curing treatments for concrete Tempering oil, bonding oil, and highly conjugated oils for hardboards
Seed	Specialty Edible Products: <ul style="list-style-type: none"> - cakes, muffins - bread products (whole seed or flour) - replacement for sesame seed in baking products - cooked and dry cereals
Seed & Oil	Health Food: <ul style="list-style-type: none"> - source of linolenic acid - to make pills - inclusion in pharmaceutical mediator mutations
Linseed Meal	High protein animal feed Seed, oil, meal: Dairy and beef cattle, swine and poultry feed and also to increase levels of linolenic acid in food products, i.e. eggs, meat and milk Pet Foods: seed and meal Fish feed in fish culture: Seed and oil - source of linolenic acid required by growing fish, i.e. salmon